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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/787,450	02/26/2004	Garo J. Derderian	2269-4097.1US (97-1252.01)	7825
24247	7590	09/05/2006	EXAMINER	
TRASK BRITT P.O. BOX 2550 SALT LAKE CITY, UT 84110			MALDONADO, JULIO J	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 09/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/787,450

Applicant(s)

DERDERIAN ET AL.

Examiner

Julio J. Maldonado

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 August 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 27 and 73-80 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 27, 73-78 and 80 is/are rejected.
- 7) ☒ Claim(s) 79 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. The final rejection as set forth in the office action mailed on 7/26/2006 is withdrawn in view of applicants' response filed on 8/18/2006.
2. Claims 27 and 73-80 are pending in the application.

Allowable Subject Matter

3. The indicated allowability of claim 27 is withdrawn in view of the newly discovered reference(s) to Visokay et al. (U.S. 6,600,183 B1) in view of Hu (U.S. 5,633,200) and Lu et al. (U.S. 6,100,188). Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 27, 73-75, 77 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Visokay et al. (U.S. 6,600,183 B1, hereinafter Visokay) in view of Hu (U.S. 5,633,200) and Lu et al. (U.S. 6,100,188, hereinafter Lu).

Visokay (Figs.2, 3, and 9a-9f) teaches a method of establishing electrical contact between a semiconductor substrate (200) and a semiconductor device including providing a substrate (200) and with an overlying insulating layer (900); etching a hole through the insulating layer (900) to the substrate (200); introducing doped polycrystalline silicon (904) into the hole; removing a portion of the doped polycrystalline

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silicon (904) from said hole; introducing a titanium layer (906) within the hole over the doped polycrystalline silicon (904); introducing tungsten nitride layer (908) over said doped polycrystalline silicon (904); siliciding the titanium layer (906); forming a ruthenium layer (210) labeled oxidation barrier layer; and forming the semiconductor device (912, 914, 916) over the tungsten nitride layer (908) (Visokay, column 7, lines 51 – 59, column 3, line 59 – column 4, line 34 and column 9, line 61 – column 11, line 56).

Visokay fails to teach forming the tungsten nitride layer by forming a tungsten layer over the doped polycrystalline silicon and nitridizing said tungsten layer to form said tungsten nitride layer. However, Hu (Figs.3-10) teaches a method of forming a salicide stack including the steps of forming a doped silicon layer (30) over a substrate (28); forming a titanium layer (34) over said doped silicon layer (30); siliciding said titanium layer (34); forming a tungsten layer (38) over said silicided titanium layer (50); and nitridizing said tungsten layer (38) in a nitrogen plasma environment, to form a tungsten nitride layer (42), wherein said salicide stack can be applied to formation of word line or to the formation of local interconnects (column 7, line 36 – column 9, line 36).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Visokay and Hu to enable forming the tungsten nitride of Visokay according to the teachings of Hu, because this would result in a tungsten nitride layer with large grain size which exhibits high thermal stability and high electrical conductivity (Hu, column 3, lines 1 – 3).

The combination of Visokay and Hu fail to teach performing a nitridation step under a N_2/NH_3 ambient at a temperature of about $360^\circ C$. However, Lu (Fig.1) teaches a nitridation process including the steps of performing said nitridation process using a N_2/NH_3 plasma ambient at a temperature between about $300 - 500^\circ C$, and a pressure between about 0.1 – 5 torr (Lu, column 3, lines 31 – 67). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Visokay and Hu with Lu to enable the nitridation step of Visokay and Hu to be performed according to the teachings of Lu because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed nitridation step of Visokay and Hu and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Still the combination of Visokay, Hu and Lu fail to disclose wherein nitridation step is performed at a temperature of $360^\circ C$ and a pressure of approximately 4.5 torr. However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the temperature and pressure range disclosed in the combined teachings of Visokay, Hu and Lu to arrive at the claimed invention.

6. Claim 76 is rejected under 35 U.S.C. 103(a) as being unpatentable over Visokay et al. ('183) in view of Hu ('200) and Lu ('188) as applied to claims 27, 73-75, 77 and 80 above, and further in view of Tsunemine (U.S. 5,699,291).

The combination of Visokay, Hu and Lu substantially teach all aspects of the invention including removing a portion of the doped polysilicon plug (Visokay, column 7, lines 51 – 59), but fail to disclose wherein removing said portion comprises etching the doped polycrystalline silicon. However, Tsunemine in a conventional method of forming polysilicon interconnects teaches forming said polysilicon interconnect (12); and etching back said polysilicon interconnect (Tsunemine, column 3, lines 13 – 20). Furthermore, Tsunemine teaches, "...Although the height of the step portion could be reduced by adjusting etching conditions, it is impossible to eliminate the step portion because the polysilicon film has a higher etching rate than interlayer insulating film..." (Tsunemine, column 3, lines 13 – 20). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Visokay, Hu and Lu with Tsunemine to enable the removing of a portion of the doped polysilicon plug of the combination of Visokay, Hu and Lu according to the conventional method disclosed in Tsunemine to arrive at the claimed invention and because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed removing step of Visokay, Hu and Lu and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

7. Claim 78 is rejected under 35 U.S.C. 103(a) as being unpatentable over Visokay et al. ('183) in view of Hu ('200) and Lu ('188) as applied to claims 27, 73-75, 77 and 80 above, and further in view of Yeh (U.S. 5,410,185).

The combination of Visokay, Hu and Lu substantially teach all aspects of the invention but fail to disclose wherein said chemical vapor deposition process is selective chemical vapor deposition. However, Yeh (Figs.5-9) teach depositing a metal layer (16) such as tungsten or any other refractory metal by either blanket or selective chemical vapor deposition (column 5, lines 7 – 21). It would have been within the scope of one of ordinary skill in the art to combine the teachings of The combination of Visokay, Hu and Lu with Yeh to enable the depositing step of The combination of Visokay, Hu and Lu to be performed according to the teachings of Yeh because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed depositing step of The combination of Visokay, Hu and Lu and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Allowable Subject Matter

8. Claim 79 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. The following is a statement of reasons for the indication of allowable subject matter: the prior art fails to teach wherein siliciding the titanium layer comprises exposing the semiconductor substrate to TiCl_4 with a reactive gas and a carrier gas at a temperature about 400°C in a reaction chamber under a pressure of approximately 0.2 to 2 torr while an rf voltage is applied to the reaction chamber.

Response to Arguments

10. Applicant's arguments with respect to claim 27 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

11. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (<http://portal.uspto.gov/external/portal/pair>) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.


12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

13. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at <http://www.uspto.gov/web/info/2800.htm>.



Julio J. Maldonado
August 31, 2006

Julio J. Maldonado
Patent Examiner
Art Unit 2823



George Fourson
Primary Examiner